CHOCTAW CREEK BRIDGE
Texas Historic Bridges Recording Project II
Spanning Choctaw Creek
Bells vicinity
Grayson County
Texas

HAER No. TX-85



PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C St. NW
Washington, DC 20240

# HISTORIC AMERICAN ENGINEERING RECORD

## CHOCTAW CREEK BRIDGE HAER No. TX-85

Location: Spanning Choctaw Creek, ~~Bells vicinity~~,
Grayson County, Texas.
UTM: 14/733610/3726095
USGS Quad: Ambrose, Tex.
(7.5-minute series, 1984).

Date of Construction: ca. 1915.

Fabricator: William H. C. Greer, Sherman, Texas.

Present Owners: Juan Bernal and Jerry Pedigo.

Present Use: Abandoned and not accessible to the public.

Significance: The Choctaw Creek Bridge is the only known surviving example of a Greer patent suspension bridge. It is also part of a much larger population of suspension bridges that once existed throughout north central Texas.

Historian: Mark M. Brown, Ph.D., August 2000.

Project Information: This document was prepared as a part of the Texas Historic Bridges Recording Project II performed during the summer of 2000 by the Historic American Engineering Record (HAER). The project was sponsored by the Texas Department of Transportation (TxDOT), Environmental Affairs Division.

## INTRODUCTION

The Choctaw Creek Bridge is a parabolic suspension bridge with a main span approximately 120' long and a roadway 10'-3" wide.[1] The unstiffened wooden deck is suspended from wire rope cables by metal rods. At the western approach, the bridge towers are fabricated of metal pipe and rise 14'-5-3/4" above the road surface and 21'-5-1/2" above the ground. Each tower consists of two pipes approximately 1'-8" apart and arranged on axis parallel with length of the deck. Sharp hammer blows to the tower pipes produce a solid sound, suggesting that the pipes are filled with a material like concrete. Four castings maintain spacing between the pipes. The top casting caps the pair of pipes and also serves as a saddle for the suspension cable. The bottom-most casting, what Greer calls a "tie plate," slips over the two pipes and rests on a third pipe located between the other two. Metal rods connected to these tie plates form vertical cross-bracing below the deck level and keep the towers from spreading outward. The remaining castings are also slipped over the pipes and are kept in position with set screws. A 10" x 10" wooden beam rests on the lowest tie plate and extends more than 3'-7" beyond the tower centers. A 3-1/2" x 3-1/2" inch angle connecting this transverse beam to the casting immediately above is intended to serve as a further bracing against outward thrust of the pipe towers. Similar size angles serve as portal bracing between the top four tower castings.

On the western approach, the 2-1/4" diameter suspension cables enter the ground 54' from the towers. Timber bents support the western approach spans. The main span is hung from 1" diameter suspended rods spaced an average of 2' apart. The upper ends of these rods, in the shape of a shepherd's crook, hook onto the suspension cables. The opposite ends are threaded and pass through 2-1/4" x 11" wood deck beams. A wide variety of fasteners and spacers, including eyes cut from eye-bars, currently keep the remaining deck beams in place. On the northwest bridge tower, one of what must have been two metal angles, perhaps the same dimensions as the angles on the portal bracing, is connected to alternate suspender rods with U-bolts. Termed a "brace" by bridge designer William Henry Clay Greer, the intact angle is attached to the tower by a metal clamp just below the saddle casting. A similar clamp resting on the tower tie plate immediately below the saddle and a corresponding pair of clamps on the southwest tower suggests there were once eight such angles on the original bridge.

A 3-3/4" x 9-1/2" wheel, or hub, guard is bolted to the deck beams on edge. Instead of stringers, the deck floor consists of 2" thick planking laid at a 45-degree angle directly on the deck beams. While there is no apparent discernable pattern, some of the deck beams are notched underneath at the point where the suspender rods emerge from the wood. This, and the haphazard mix of fasteners and spacers, suggest that the deck has been altered or rebuilt.

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[1] Dimensions are based on field measurements made during summer 2000 of the western third of the bridge. Located on a long abandoned road, the deck is no longer completely intact and the eastern approach is blocked by very dense growth.

## HISTORY

The history of the Choctaw Creek Bridge is sparse because of the burning of the Grayson County Courthouse and because of the obscurity of the bridge's builder. Before the establishment of the Texas Highway Department in 1917, county authorities constructed most rural Texas bridges. While almost all county records survived the 1930 courthouse destruction, the minutes of the County Commissioners' Court were lost. Less dramatic is the fate of William Henry Clay Greer. While Greer was awarded four patents for suspension bridges between 1889 and 1912, duly noted in Jakkula's "A History of Suspension Bridges in Bibliographical Form," he has heretofore escaped notice as a Texas bridge designer and builder.[2]

Grayson County straddles the drainage divide between the Red River in the northern part of the county, which includes Choctaw Creek, and the Trinity River in the south. Transportation was difficult in the county until the coming of the railroads in the 1870s and 1880s. In some respects the railroads only increased the pressure for roads and bridges because the railroads offered access to distant markets for the county's agricultural production, particularly cotton, flour, wheat, corn, and cottonseed oil. By the turn of the century, the county seat at Sherman became a regional industrial center with flour mills, cotton gins and mills, two foundries, and patent medicines. Now abandoned, Choctaw Creek Bridge was once on the Sherman-to-Bells road, particularly well used by the Smith Oaks community on the west and the Isom Cemetery area to the northeast. According to one long-time resident, during the 1940s, Smith Oaks had a cotton gin, a grocery store, a flour mill, and was one of three railroad stops between Sherman and Bells.[3] It was within this context of a predominantly agricultural, but ambitious industrial center, that Greer filed his first patent in the spring of 1889.

In its 1893-94 edition, a Sherman city directory listed Greer as a bridge builder. Subsequent directories report him as a traveling salesman (1905-06, 1909) and bridge contractor

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[2] The patents are: William Henry Clay Greer, "Suspension Bridge," U.S. Patent No. 411,499 (24 Sept. 1889); "Suspension Bridge," U.S. Patent No. 513, 389 (23 Jan. 1894); "Suspension Bridge," U.S. Patent No. 968,552 (30 Aug. 1910); "Suspension Bridge," U.S. Patent No. 1,019,458 (5 Mar. 1912); Arne A. Jakkula, "A History of Suspension Bridges in Bibliographical Form," *Bulletin of the Agricultural and Mechanical College of Texas*, 4th ser., vol. 12, no. 7 (1 July 1941): 456, 458-59, 462. For more on bridges in Grayson County see Historic American Engineering Record (HAER), National Park Service, U.S. Department of the Interior, "Dennison-Durant Bridge," HAER No. TX-27; "Iron Ore Creek Bridge," HAER, No. TX-38; "Little Mineral Creek Bridge," HAER No. TX39, and "Choctaw Bottoms Road Bridge,"HAER No. TX56.

[3] The bridge was in use at as late as 1958 and was only closed when the bridge across the slough east of Choctaw Creek washed away. Jerry Durham, conversation with the author, 16 Aug. 2000. Donna J. Kumler, "Grayson County," in *The New Handbook of Texas*, vol. 3 (Austin: The Texas State Historical Association, 1996), 298-9; Brian Hunt, "Sherman, Texas," in *The New Handbook of Texas*, vol. 5: 1021-23; on Bells, Texas, see George Kimbrough, "Bells, Texas History Taken from the Sherman Democrat 4 July 1978," in *The History of Grayson County Texas*, ed. Grayson County Frontier Village (N.p., Grayson County Frontier Village, 1979), 49-50; Jack Langford, conversation with author, 14 Aug. 2000.

(1916). In 1918, we learn that Lenora Greer is his widow.[4] The remaining sources of information on Greer and his work consist of historic photographs of bridges bearing a striking resemblance to the Choctaw Creek Bridge, a series of contracts awarded him in Montague County (two counties west of Grayson), and his patents.

Historic photographs found to date are immediately recognizable to those who are familiar with the Choctaw Creek Bridge.[5] Common characteristics include the configuration of the pipe towers, the closely spaced deck beams suspended from rods hooked over the cable, and the wheel guard to protect the suspender rods. Most of photographs reveal angle braces descending to the deck from the towers. A photograph of the Denton Creek Bridge in Montague County shows a connection from the deck near the towers upwards to the suspension cables. Other photographs showing the deck surface make it clear that diagonal placement of the floorboards was common. Finally, several photographs taken of the Cherry Street Bridge in Sherman, Texas, reveal posts rising from the deck in the middle of the bridge, braced by cables or tension rods. Additional features visible include the connection between the deck and the diagonal angles, a wide hub guard, and what seems to be a small cable that runs under and parallel to the suspender cable. The remains of the diagonal angles on the Choctaw Creek Bridge raise the question whether the other features also once existed. Given the possibility of incremental developments, and given the uncertainty of the construction date of Choctaw, it may be impossible to know. It does, however, seems reasonable to suggest that the current wood deck is only an approximate version of the original because it does not provide for connections visible in some of the photographs.

In addition to those in Grayson County, Greer constructed at least seventeen bridges for Montague County. Indeed, Montague County is the only other place where Greer's work is documented, thus offering rare insight into his practice. Greer first appears in the minutes of the Montague County Commissioners' Court in 1894. Initially doing business as the Greer Bridge Company, his final work was done in 1915 under the name Western Bridge Company. While most of Court Minutes yield little more information than location, length, and cost of the bridges, the 1915 minutes record detailed specifications for three bridges with 100', 60', and 70' main spans costing $2,100, $1,100, and $1,200 respectively. Promised construction times ranged from

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[4] *Sherman City Directory*, vol. 1 (n.p.: Maloney Directory Company, 1893-94), 55; *Directory of the City of Sherman* (Sherman, Tex.: The Sherman-Dennison Directory Company, 1905-1906), 71; *Sherman City Directory*, vol. 7 (n.p.: Maloney Directory Company, 1909), 283; R. L. Polk, *Sherman City Directory* (Sioux City, Iowa: R. L. Polk and Co., 1916), 339; R. L. Polk, *Sherman City Directory*, (Sioux City, Iowa: R. L. Polk and Co., 1918), 135.

[5] See *Centennial Survey 1882-1982: Bowie Area* (Saint Jo, Tex.: Bowie Centennial Book Committee, 1982), 204; The Sherman Democrat, *Reflections: Sharing Sherman and Grayson County's Past*, vol. 1 (Marceline, Mo.: D-Books Publishing Co., 1994), 73; Negative No. 1363, Photo Library, Travel Division, Texas Department of Transportation, Austin, Tex.; Photographs of Cherry Street Bridge Collapse, late 1940s, Sara Lane Collection, Sherman, Tex.; Photographs of Abraham Aleman and David Lopez, ca. 1945, Israel Rodriguez Collection, Sherman, Tex. Special thanks to members of the Grayson County Historical Society for hunting down many of these images and for other material assistance to the team: President Wayne Cole, R. C. Harmon, Marylou Lueb, and John Ramsey.

one to two months.[6]

The specifications themselves are fairly formulaic, which makes for easier comparison. The contracts called for 2" diameter steel cables with an ultimate strength of 125 tons for the longest bridge and 1-3/4" steel cables with 75 tons ultimate strength for the other two. Anchorages consisted of 10" x 6' Bois d'arc logs encased in concrete to ground level.[7] Making no reference to pipe towers, the contracts called for eight concrete-filled steel piers to support the cables. The height of the towers above the roadway varied from 8' to 9', but the rated capacity of each "steel pier" was twenty-seven tons for the 100' bridge and nineteen tons for the shorter spans. The suspender rods were specified to be 7/8" diameter soft steel and spaced 2' apart. It is curious that while all three bridges used 1/4" x 2-1/2" x 2-1/2" steel angles between the tie clamps of the tower and the deck, the 70' span had twelve versus eight for the others. In a detail no longer extant at Choctaw Creek, 3/4" steel bolts attached each angle brace to the hub guard or rail. The contracts made no reference to any other deck stiffening system. The deck beams, or floor joists, were 3" x 10" heart pine with 2" or 3" diagonally laid planking. Wheel guards, always attached to the joist with 5/8" x 24" steel bolts, were 4" x 10" or 4" x 12" pine.[8]

## GREER'S PATENTS

### September 24, 1899: U.S. Patent No. 411,499

Most of the features of Greer's first patent do not seem patented in and of themselves, rather it is the overall *system* that Greer claimed in his patent application. His objectives were twofold: to reduce material and labor costs by reducing the number of parts, and to accommodate uneven settling or misalignments with adjustable components. Greer's first patent is both similar to and different from the Choctaw Creek Bridge. The patent included longitudinal saddle castings and piers parallel to the roadway (which contrasts with the work of fellow Texan E. E. Runyon), tie plates on the piers (Greer does not mention pipe), and diagonally laid decking (illustrated but not mentioned in the text).[9] A striking difference is the use of deck stringers. One illustration also shows lower-lateral cross-bracing underneath the deck, though this common

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[6] Montague County, *Index to Montague County Commissioners' Court Minutes*, vol. 2 (County Clerk's Office, Montague County Courthouse, Montague, Tex.), 100-2.

[7] Also known as Osage Orange, Bois d'arc was used by indigenous peoples to make bows. It is a very durable hardwood resistant to salt and insects often used for fence posts, house and bridge piers. Special thanks to Karen Clary, Ph.D., Environmental Specialist, Biological Resources Management, Texas Department of Transportation, for this information.

[8] Montague County, *Minutes of the Montague County Commissioners' Court*, vol. H (County Clerk's Office, Montague County Courthouse, Montague, Tex.), 275-7 (17 May 1915), 279-80 (14 June 1915), 284-85 (18 June 1915).

[9] On the work of Edwin Elijah Runyon, see Historic American Engineering Record (HAER), National Park Service, U.S. Department of the Interior, "Bluff Dale Suspension Bridge," No. TX-36 and "Barton Creek Bridge," HAER No. TX-87.

nineteenth-century design feature is not mentioned in the known contracts, discussed in the other patents, nor certain to have ever been used at Choctaw. Greer envisioned a combination of adjustable tie plates with set screws and suspender rods with turnbuckles sufficient to compensate for any shifting of the towers; he believed these two features made it possible to maintain a level deck. Suggesting that set screws would be sufficient to support the load seems dangerous, and Greer changed this detail in his second patent. The anchorage largely consisted of a series of stacked metal plates the width of the bridge. Greer's language is ambiguous, but he seemed to be providing for parallel wire cables when he described how wires from the cables passed through holes in two of the plates, were bent and secured with the third plate.

**January 23, 1894: U.S. Patent No. 513,389**

In his second patent, Greer primarily focused on improvements to the anchorage and deck systems. The new anchorage consisted of metal bars--Greer used the term "loops"-- wrapped around a horizontal timber or iron bar. Cable wires were attached to the "loop" and the entire unit was held in place by four vertical piles driven into the ground. In his third and fourth patents, Greer simplified this anchorage by encasing the horizontal member in concrete. Based on the Montague County contracts, we can presume that he had Bois d'arc in mind when specifying a "tough wood." Greer introduced two enhancements to the deck system in his second patent. First, he sandwiched the outer edges of the floorboards between two boards, presumably keeping the stringer system of the first patent. More importantly, he introduced a trussing system that connected the bottom of the deck with the suspension cable diagonal rods, which were equipped with turnbuckles. While no evidence has come to light that Greer ever employed the system, if properly tensioned it could have significantly reduced vertical deck motion. This patent also introduced the fully developed towers with the third pipe supporting the lowest tie plate and the hooked suspender rods as seen at the Choctaw Creek Bridge.

**August 30, 1910: U.S. Patent No. 968,552**

In 1910, Greer finished his third effort to reduce vertical oscillation of the deck. He inserted metal plates running the length of the deck between the deck beams and nuts that secure the deck beams to the suspender rods. Perhaps more importantly, he developed a deck truss with angles for its top and bottom chords. His illustration depicts a double intersection Warren truss, though a particular bracing pattern is not specified in the text. Like the trussing system of the second patent, evidence of the actual use of this Warren truss-like system has not come to light, but for one possible exception. The previously mentioned photograph of an unidentified bridge suggests the possibility of some sort of longitudinal member running beneath the deck beams.[10] Secondary developments include the final arrangements of the portal bracing as found at Choctaw, and a simplified description of the anchorage.

In the absence of more biographical information, it is difficult to a speculate why there

[10] Negative No. 1363, *op cit.*

were sixteen years between the second and third patents. But Greer did change his patent attorney during the interval. Z. P. Dederick of Catskill, New York, became the Superintendent of the Sherman Iron Works in the 1860s, invented a well-drilling machine, and eventually became Sherman's owner. At some point, Dederick became a registered patent attorney – an arrangement that he and Greer obviously found mutually advantageous.[11]

**March 5, 1912: U.S. Patent No. 1,019,458**

In his fourth and final patent, Greer acknowledged for a second time that his previous patent did "not include means for effectively bracing and anchoring the structure."[12] He replaced the trussing systems of the previous two patents with the diagonal braces whose remnants are seen at Choctaw Creek and in several of the historic photographs. He eliminated all mention of deck stringers, but retained the longitudinal metal plates below the deck beams. Greer sought to further reinforce the deck with the equivalent (at least visually) of an inverted Fink truss system in the middle of the span. Tension rods with turnbuckles ran from the hub guard to a pipe approximately the same height as the tower. Engineering consultant Stephen Buonopane noted that the as-yet-unstudied behavior of the "inverted Fink truss" system depends on the construction sequence. If, for example, sufficient tension was placed on the diagonals attached to the mid-span post during construction, then a live load at mid-span would reduce the amount of compression in the vertical. This in turn would reduce some, but not all, of the tension in the diagonals. Some of the mid-span load would then be moved closer to the towers, where the deck is stiffer.[13]

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[11] "Sherman Iron Works," *Sherman Democrat*, Twenty-First Anniversary Number (1901), 6.

[12] Greer, U.S. Patent No. 1,019,458, lines 18-9.

[13] Stephen G. Buonopane, engineering consultant, to author, 30 and 31 July 2000. For example of a stayed bridge with a king post truss, see Historic American Engineering Record (HAER), National Park Service, U.S. Department of the Interior, "Chow Chow Suspension Bridge," No. WA-5.

## CONCLUSION

The Choctaw Creek Bridge is the only known surviving example of a Greer patent suspension bridge. It is also part of a much larger population of suspension bridges constructed throughout north central Texas between 1885 and 1940. Greer might well have been the last of the empirical inventors who emerged from this Texas tradition. It appears that academically trained engineers were involved in the design of many of the suspension bridges built after Greer's death.[14]

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[14] For more on this tradition see "Texas Suspension Bridges," HAER, No. TX-98; "Structural Study of Texas Cable-Supported Bridges," HAER, No. TX-104; See also the following individual reports: "Waco Suspension Bridge," HAER, No. TX-13 ; "Bluff Dale Suspension Bridge," HAER, No. TX-36; "Beveridge Bridge," HAER, No. TX-46; "Clear Fork of the Brazos Suspension Bridge," HAER, No. TX-64; "Barton Creek Bridge," HAER, No. TX-87; "Rock Church Bridge," HAER No. TX- 81; "Choctaw Creek Bridge," HAER, No. TX-85.

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